



STUDY OF STRENGTH PARAMETERS ON CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT BY SODIUM POLYACRYLATE AND FLY ASH

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ABSTRACT

Study of strength parameters on concrete with partial replacement of cement by sodium polyacrylate and fly ash. The present report deal with manages investigation of sodium polyacrylate and fly ash remains is utilized as a part of strengthened cement. The sodium polyacrylate to retain the expansive measure of water to change over into gel in the mean time the volume increments relatively. Also, fly ash use in concrete increases fins volume and decreases water content and thus reduces bleeding of concrete. The measurements of sodium polyacrylate changes from 1% to 4% , and fly ash 5% to 20% blend in cement with w/c ratio 0.45 gives great quality of cement .strength is measuring with two methods first one natural curing and second one water curing. This two methods strength is decreases and volume is increases so setting time are much let and shrinkages, voids are formed and gives good strength of concrete.

Key words: sodium polyacrylate, fly ash, compressive strength, absorbent.

Cite this Article: U. Srinivasa Rao, M. Suresh Babu, Study of Strength Parameters on Concrete With Partial Replacement of Cement By Sodium Polyacrylate And Fly Ash. *International Journal of Civil Engineering and Technology*, 8(3), 2017, pp. 1123–1130.

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1. INTRODUCTION

The main characteristic of the sodium polyacrylate (SAP) is its ability to absorb relatively large amount of water and converts it into gel, then releases it slowly with time. The volume of the gel increases in proportion with the amount of water absorbed ^[1]. Concrete is mixture cement, sand, aggregate, water. Throughout the life of concrete, water has central Importance. It is an important component in the mixing, curing and hardening of concrete ^[2].and this

material heat can be produced. Next one is fly ash the use of fly ash in Portland cement concrete (PCC) has many benefits and improves concrete performance in both the fresh and hardened state. Fly ash use in concrete improves the workability of plastic concrete, and the strength and durability of hardened concrete. Fly ash use is also cost effective. When fly ash is added to concrete, the amount of Portland cement may be reduced^[3]. But most of the research has been limited to few percentages of cement replacement or less grades of concrete^[4]. Fly ash is a beneficial mineral admixture for concrete. It influences many properties of concrete in both fresh and hardened state^[5]. He concluded that the shrinkage of concrete due to loss of water to the surrounding is the cause of cracking both in the plastic and in the hardened stage^[6]. Fly ash is commonly used in concrete in replacement ranging from 0% to 30% by weight of the total cementations material^[7]. Also, approximately 1 tonne of CO₂ is released into the atmosphere during the production of 1 tonne of cement^[8]. So this two material to partial replacement of cement by sodium polyacrylate and fly ash 50% cement replace and remaining 50% sodium polyacrylate and fly ash added to concrete. Material added in concrete step by step process. First one is sodium polyacrylate(1%, 2%, 3%, 4%) and next one fly ash(5%, 10%, 15%, 20%) and w/c ratio is 0.45 mix design M₃₀(1: 2 :2.87). compressive strength testing in two methods are proposed first one natural curing and second one is water curing. Results are calculated in three sets 3days, 7days, 28days each set having strength is decreases and volume increasing, much of shrinkages, voids are formed gives a good strength.

2. MATERIALS AND METHODS

2.1.1. Sodium polyacrylate

Sodium polyacrylate used in this study is super absorbent polymer ,also known as water-lock which is a sodium salt of polyacrylic acid with the chemical formula $[-CH_2-CH(COONa)-]_n$ SPA is anionic polyelectrolytes with negatively charged carboxylic groups in the main chain. it has the ability to absorb as much as 200 to 300 times its mass in water. as shown in Figure 1, 2. Specific gravity of sodium polyacrylate is 2.16.

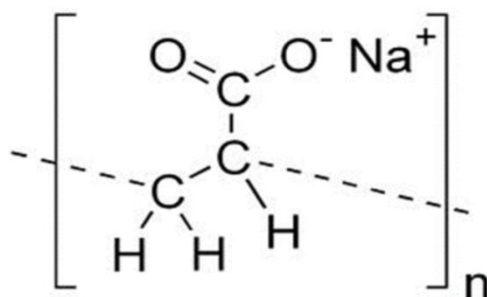


Figure 1 polyacrylic acid with the chemical formula



Figure 2 sodium polyacrylate

2.1.2. Fly Ash

This kind of ash is extracted from flue gases through Electrostatic Precipitator in dry form. This ash is fine material & possesses good pozzolanic property. The pozzolanic property of fly ash makes it a resource for making cement and other ash based product. Fly ash, which is largely made up of silicon dioxide and calcium oxide, can be used as a substitute for Portland cement, or as a supplement to it using fly ash cement in place of or in addition to Portland cement uses less energy, requires less invasive mining, and reduces both resource consumption and CO₂. as shown in Figure 3. Specific gravity of fly ash is 2.78.



Figure 3 fly ash

2.2. Methodology

SP1F5, SP2F10, SP3F15, SP4F20, (SP is defined as sodium polyacrylate and F is defined flyash) SP1F5 means one percentage of sodium polyacrylate and five percentage of flyash. SP0F0 means normal concrete.

2.2.1. Slump test

The slump test used find out the workability of concrete slump value of sodium polyacrylate used SP1F5 in concrete as various percentages replace in various readings. The slump test used in replaced by concrete measurement are 100mm as shown in Table 1.

Table 1 Slump Test

SI NO	NAM OF MIX	SLUMP(mm)
1	SP0F0	150
2	SP1F5	100
3	SP2F10	95
4	SP3F15	88
5	SP4F20	83

2.2.2. Compressive strength of concrete test

To calculate the concrete strength of concrete by using compaction testing machine. and the mix proportion is taken as 1:2:2.87, where the water cement ratio 0.45, percentage of materials SP1F5, SP2F10, SP3F15, SP4F20, cubes are prepared for each set to be tested by compression three of each set 3 days, 7 days, 28 days total number of cubes 48 i.e., natural curing 24 cubes and water curing 24 cubes, as shown in Table 2, 3.

2.2.3. Natural curing

The natural curing admix concrete cubes is used in the material sodium polyacrylate and fly ash. SP1F5, SP2F10, SP3F15, SP4F20, mixing in concrete cubes tested by compression three of each set 3days, 7days, 28days.the total cubes 24.as shown in Table 2.

Table 2 Natural Curing

SI NO	NAME OF MIX	3DAYS	7DAYS	28DATS
1	SP0F0	29.67	34.35	37.85
2	SP1F5	22.39	23.52	24.41
3	SP2F10	8.52	14.53	22.67
4	SP3F15	8.28	11.48	19.74
5	SP4F20	3.63	4.36	8.86

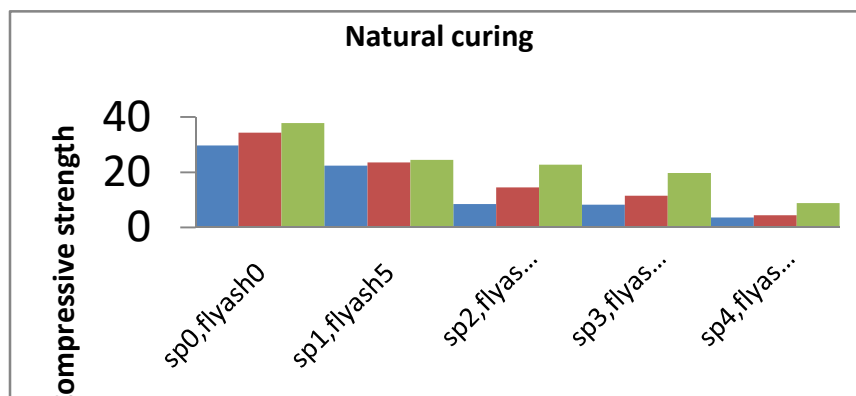


Figure 4 Natural curing

2.2.4. Water curing

A Water curing mix material in cubes sodium polyacrylate and fly ash.SP1F5, SP2F10, SP3F15, SP4F20, mixing in concrete cubes tested by compression three of each set have 3days, 7days, and 28days. The total cubes 24.as shown in Table 3.

Table 3 Water curing

SI NO	NAME OF MIX	3DAYS	7DAYS	28DAYS
1	SP0F0	31.35	33.08	37.25
2	SP1F5	25.8	29.64	32.6
3	SP2F10	15.6	27.53	28.58
4	SP3F15	14.86	20.96	24.58
5	SP4F20	13.40	19.23	22.25

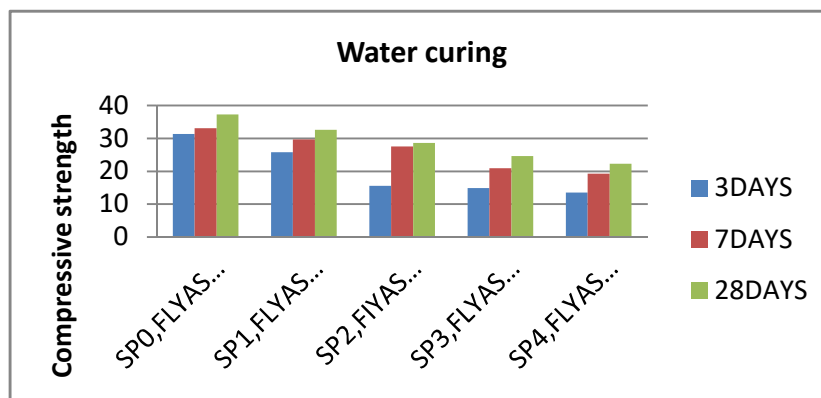


Figure 5 Water curing

3. RESULTS AND DISCUSSIONS

3.1. Volume increasing

I take SP1F5 water content is 650ml and volume can be increases to the 0.277m^3 . and second trial in SP2F10 water content is 850 ml volume increases to 0.283m^3 . third one is SP3F15 water content is 1050 ml volume increases to 0.288m^3 last one is SP4F20 water content is 1250ml volume increases to 0.294m^3 as shown in Table 4. Material increases automatically water content is also increases and water can be absorbed with material volume is also increases step by step water is added to the material volume is also increases. SP1F5 water ratio is 650ml and SP2F10 water ratio 850ml .one and two percentage material increases and water content is also increases each percentage water is 200ml increases as shown in Table 5. But Concrete weight is decreases inversely proportionally, so material and water added to the concrete weight decreases 8600 grams and 6900 grams, shown in Table 6. strength is increases and volume increases, so sodium polyacrylate used in concrete mixes.

Table 4 Volume increasing

SI NO	NAME OF MIX	VOLUME INCREASING (m^3)
1	SP0F0	0.000
2	SP1F5	0.277
3	SP2F10	0.283
4	SP3F15	0.288
5	SP4F20	0.294

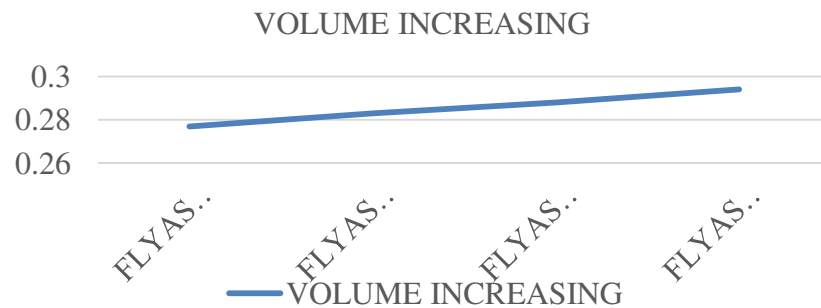


Figure 6 Volume increasing

Table 5 Water content:

SI NO	NAME OF MIX	WATER(ml)
1	SP0F0	450
2	SP1F5	550
3	SP2F10	650
4	SP3F15	850
5	SP4F20	1050

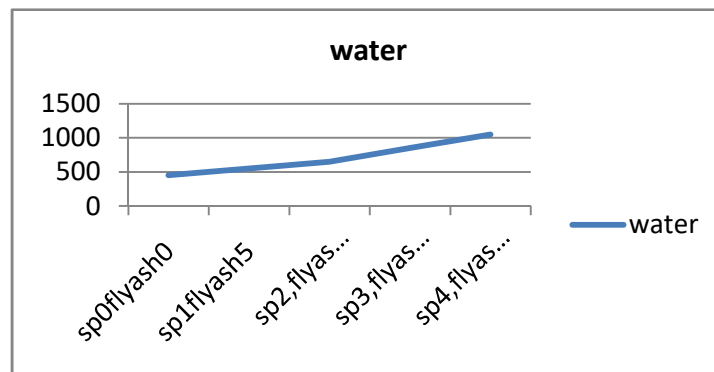


Figure 7 Water content

Table 6 Weight of concrete

SI NO	NAME OF MIX	WEIGHT(grams)
1	SP0F0	9120
2	SP1F5	8600
3	SP2F10	7900
4	SP3F15	7250
5	SP4F20	6900

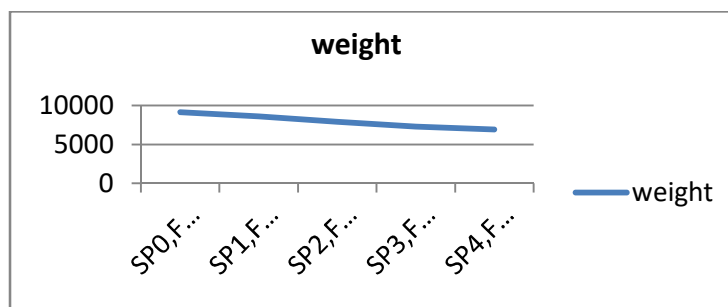


Figure 8 Weight of concrete

4.CONCLUSION

- The use of sodium polyacrylate and fly ash in concrete mix has the potential to decrease the concrete strength due to water curing and natural curing process.
- The sodium polyacrylate and fly ash is used in concrete mix, the volume is also increases.
- This material heat can be produced and voids, shrinkages developed.
- Water curing 7 days compressive strength of M30 grade concrete is 29.64Mpa with SP1F5 weight of cement .
- We hope that compressive strength should be gave a positive result as compared to normal concrete.

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